

Appl. No. : 10/623,482
Filed : July 18, 2003

REMARKS

In the final Office Action mailed on November 3, 2005, the Examiner rejected all pending claims under 35 U.S.C. § 103(a). In the Advisory Actions mailed on February 10, 2006 and April 6, 2006, the Examiner maintained his rejections. Applicants respectfully request full consideration of the remarks contained herein.

Rejections Under 35 U.S.C. § 103(a)

The Examiner has rejected all pending claims, Claims 1-22, 38-57 and 105-106, as being obvious over U.S. Patent Application Publication No. 2003/0059535 (Luo *et al.*) in view of U.S. Patent No. 6,252,295 (Cote *et al.*), so-called "Admitted Prior Art" or U.S. Patent No. 6,503,846 (Niimi *et al.*). Luo *et al.* is asserted for teaching the general features of independent Claims 1 and 38. The Examiner stated, however, that Luo *et al.* does not teach trisilane as a silicon source (Luo *et al.* teaches using silane and disilane, but does not teach that trisilane is a possibility). Cote *et al.* (U.S. Patent No. 6,252,295) is asserted to satisfy this deficiency. Cote *et al.* discloses trisilane in a list of "silicon containing reactive gases." Cote *et al.*, Col. 2, lines 53-55. The Examiner appears to assert that Cote *et al.* itself provides a motivation to use trisilane in the process of Luo *et al.* because, by placing trisilane and silane on the same list as disilane, Cote *et al.* teaches that trisilane can be used generally as a substitute for silane and disilane. Alternatively, the Examiner has asserted that U.S. Patent Application Publication No. 2003/0082300 (Todd *et al.*) or U.S. Patent No. 4,363,828 (Brodsky *et al.*), each discussing trisilane for the processes of those patents, provide the requisite motivation to use trisilane in the process of Luo *et al.* In addition, "Admitted Prior Art" and Niimi *et al.* are asserted to disclose features of various dependent claims.

Applicants respectfully traverse the rejections.

Todd *et al.* is Not Available to Support the Rejections

Initially, as the Examiner appears to have agreed in the second Advisory Action mailed April 6, 2006, Applicants note that Todd *et al.* is not available as prior art to the present Application. The Application, including all presently pending claims, is entitled to the priority benefit of U.S. Provisional Application No. 60/397,576, filed July 19, 2002. Todd *et al.*,

Appl. No. : 10/623,482
Filed : July 18, 2003

however, was published after this date, on May 1, 2003. As a result, Todd *et al.* is ***not prior art*** to the Application.

The Examiner has asserted, however, that Todd *et al.* may still be relied upon, “to show the level of skill in the art at or around the time the invention was made.” As authority for this proposition, the Examiner has cited *Ex parte* Erlich, 3 U.S.P.Q. 2d 1011 (Bd. Pat. App. & Inter. 1992). The Examiner’s reliance on *Ex parte* Erlich is misplaced. The Board in *Ex parte* Erlich clearly indicated that it relied on a reference which was not technically prior art because the reference contained a table which tabulated numerous ***other*** publications, some of which were ***prior art***. The Board found that the table, containing references to the work of many others, was indicative of the level of skill in the art. Thus, the reference relied upon in *Ex parte* Erlich provide a survey of other work in the relevant field in that case and it was the presence of this other work which persuaded the Board that the survey reference could be relied upon.

In contrast, in the present case, the Examiner has relied upon the work of one of the ***inventors*** on the present application and to show the general level of skill of ***others*** in the field. Applicants submit, however, that the use of trisilane in Todd *et al.* was itself novel and in no way indicates the level of skill generally found in the field. Consequently, this case is not analogous to *Ex parte* Erlich since Todd *et al.* does not purport to disclose the work of others in its teachings regarding trisilane. Thus, *Ex parte* Erlich does not support reliance upon the disclosure of Todd *et al.* to show the level of skill in the art and Todd *et al.* cannot be relied upon at all to support the rejections.. See M.P.E.P. §2144 (“Legal precedent can provide the rationale supporting obviousness ***only*** if the facts in the case are sufficiently similar to those in the application.”) (emphasis added).

Luo *et al.* and Cote *et al.* Do Not Establish a *Prima Facie* Case of Obviousness

As made clear in the M.P.E.P., “the prior art must suggest the ***desirability*** of the claimed invention” in order to combine references to establish a ***prima facie*** case of obviousness. See M.P.E.P. §2143.01.I. (emphasis added). Where a ***prima facie*** case of obviousness is based upon substituting a material disclosed by one reference for a material disclosed by another reference, the materials must be “equivalents known for the ***same purpose***.” See M.P.E.P. §2144.06. (emphasis added).

Applicants stress that the art of record does not teach the desirability of replacing silane and disilane, as disclosed by Luo *et al.*, with trisilane, as disclosed by Cote *et al.* Luo *et al.* is completely silent regarding trisilane and Cote *et al.* only discloses a list containing trisilane among other silicon-containing precursors. See Cote *et al.*, Col. 2, lines 53-55. This list merely acknowledges the existence of trisilane as a silicon precursor; it does not provide any teaching regarding the *desirability* of using trisilane in the process of Luo *et al.* Consequently, Luo *et al.* and Cote *et al.* fail to establish the desirability of using trisilane in Luo *et al.*'s process and, as a result, do not establish a *prima facie* case of obvious for this reason.

Alternatively, the Examiner appears to assert that the "art recognized equivalence" of trisilane for the "same purpose" as silane and disilane provide the requisite motivation to substitute the trisilane of Cote *et al.* for the silane and disilane of Luo *et al.* See M.P.E.P. §2144.06. Applicants note that the "purpose" in the present case is the formation of layers of a "silicon-containing compound" or "silicon compound" by a *sequential* process including "depositing a silicon layer" using trisilane and then "forming a silicon-containing compound layer by exposing the silicon layer to a reactive species" or "reacting the silicon layer," as recited by independent Claims 1 and 38. While Cote *et al.* discusses the use of trisilane for its *particular* process of forming graded films by simultaneously introducing reactants, Cote *et al.* is focused on its particular process and does not teach that trisilane is *generally* equivalent to silane and disilane and can be substituted for silane and disilane for other processes, such as the sequential process of Luo *et al.* Luo *et al.* is silent regarding trisilane and, so, does not satisfy this deficiency. Consequently, it cannot be said that trisilane is recognized to be generally equivalent to silane and disilane for all processes.

The Examiner has asserted *Smith v. Hayashi*, 209 U.S.P.Q. 754 (Bd. of Pat. Inter. 1980), as supporting the Examiner's position that the disclosure of Cote *et al.* is sufficient to show the equivalence of silane, disilane and trisilane, thereby supporting a *prima facie* case of obviousness. Applicants note, however, that in that case, the Board merely found that two materials which were "known photoconductors in the art of electrophotography" were obvious substitutes for one another "in an electrophotographic environment as a photoconductor." Thus, both materials were known to be generally usable for the exact same purpose and the Board merely recognized this fact. In contrast, in the present case, Cote *et al.* lists silane, disilane or

Appl. No. : 10/623,482
Filed : July 18, 2003

trisilane for its particular process, but makes no statements regarding the general equivalence of trisilane and silane or disilane for other processes. Consequently, Cote *et al.* is not analogous to *Smith v. Hayashi*. Rather, because Cote *et al.* does not discuss trisilane outside of the particular context of its particular process, Cote *et al.* cannot be said to disclose that trisilane is generally available as a substitute in any and all other processes, as the Examiner appears to assert.

Applicants note that the mere identification of a material for use in particular processes, even if in the same field as a claim, is not sufficient to establish a *prima facie* case of obviousness. *In re Geiger*, 815 F.2d 686, 2 U.S.P.Q. 2d 1276 (Fed. Cir. 1987), is particularly instructive in this regard. In that case, the Examiner and the Board rejected claims directed to cleaning a cooling water system using particular materials. It was noted that the materials were not novel and the asserted references taught use of one or more of the materials for the particular processes disclosed by those references, but did not teach a method with the particular materials. The Court overturned the rejections, noting that while the references showed the materials to be known, the references only established that it may have been “obvious to try” the materials in the method claimed by the applicants in that case.

Similarly, in the present case, Cote *et al.* merely teaches that trisilane is a known material, usable in the process of that patent. Neither Cote *et al.* nor Luo *et al.*, however, teach the desirability of using trisilane in the process of Luo *et al.*, nor do they teach the general equivalence of trisilane and silane and disilane for other processes generally. While the Examiner appears to argue that such a teaching is present in the asserted references, Applicants note that obviousness must be supported by “clear and particular” evidence; “broad conclusory statements regarding the teaching of multiple references, standing alone, are not ‘evidence’” sufficient to support an obviousness rejection. See *In re Dembiczak*, 175 F.3d 994, 50 U.S.P.Q.2d 1614 (Fed. Cir. 1999). The asserted simply provides no support for the general teaching that the Examiner asserts. In addition, Applicants submit that the other art of record does not satisfy the deficiencies of the asserted references.

In effect, the combination of the process of Luo *et al.* with the selection of trisilane from among a list of silicon-containing precursors in Cote *et al.* is nothing more than an assertion of an “obvious to try” standard, or an assertion that trisilane *could* be employed in the process of Luo *et al.* However, “[t]he mere fact that the prior art could be so modified would not have made the

Appl. No. : 10/623,482
Filed : July 18, 2003

modification obvious unless the prior art suggested in the desirability of the modification.” *In re Gordon*, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984). In this case the Examiner has presented no rationale from the prior art for the *desirability* of trisilane in the Luo *et al.* process.

As a result, Applicants respectfully submit that the art of record does not establish a *prima facie* case of obviousness.

Brodsky Does Not Satisfy the Deficiencies of Luo *et al.* and Cote *et al.*

Like Cote *et al.*, Brodsky *et al.* is concerned with a particular process. In the case of Brodsky *et al.*, the process is the deposition of a layer of hydrogenated amorphous silicon. *See, e.g.*, Brodsky *et al.*, Col. 3, lines 28-29. Brodsky *et al.* contains no teaching that trisilane can be used as a substitute for silane and disilane generally. More importantly, the asserted benefits are inapplicable to the process of Luo *et al.*, which does not call for “hydrogenated amorphous silicon,” and there is no indication that speed of deposition is significant for the recited cyclical process of Luo *et al.* (which employs very thin silicon layers in each cycle, such that speed would not have been considered important). Consequently, like Cote *et al.*, at most, Brodsky *et al.* indicates that it would have been “obvious to try” trisilane in the process of Luo *et al.* Obvious to try, however, is not a permissible standard for obviousness. *See In re Geiger*, 815 F.2d 686, 2 U.S.P.Q. 2d 1276; *see also In re O’Farrell*, 853 F.2d 894, 7 U.S.P.Q. 2d 1673 (Fed. Cir. 1988).

Unexpected Results and Criticality

In contrast to the Examiner’s apparent assumption that silane, disilane and trisilane are simple substitutes for one another, Applicants note that the Application makes clear that this is not the case. For example, precursors such as silane have been found to form less uniform silicon layers than trisilane. When forming silicon compounds by reacting an already deposited silicon layer with another reactant, the parts of the substrate which underlie thinner parts of the silicon layers can be reacted, which can result in the formation of silicon-containing layers, such as silicon nitride layers, that have inferior electrical properties. *See, e.g.*, the Application, pp. 13-14, 34. Thus, due to the properties of the layers formed by silane, silane can be unsuitable for some processes, while trisilane would give beneficial results.

Moreover, the substitution of trisilane for more conventional precursors, such as silane and disilane is non-trivial, since trisilane has different physical properties and different requirements for deposition applications relative to such conventional precursors. Given the recipe and equipment adjustments associated with such a change of precursor, the skilled artisan would not substitute silane or disilane with trisilane without first recognizing the *particular benefits* of trisilane in this context. In sum, Applicants have established both that 1) silane, disilane and trisilane cannot be assumed to be direct substitutes for one another in all processes and 2) trisilane has criticality in the claimed process.

For example, Applicants have discovered and disclosed unexpected results: that trisilane can advantageously be utilized to form exceptionally uniform silicon layers that can sequentially be fully reacted to form films with excellent stoichiometry and superior electrical properties. *See, e.g.,* the Application, pp. 17-18, 33-34. Maximizing uniformity allows minimizing the extent of nitridation while still allowing full reaction, while also minimizing risk of nitriding underlying structures. *See, e.g.,* the Application, pp. 25-26 and 36. As a result, trisilane can advantageously be applied in the claimed cyclic process to form silicon-containing compound layers. These particular advantages stem from the use of trisilane. While the Application discloses an advantageous cyclic process for depositing superior silicon-containing compound layers using trisilane, the art of record simply does not recognize any desirability in applying trisilane in a sequential process such as that presently claimed.

Accordingly, Applicants submit that the pending claims are allowable over the art of record. Applicants have not specifically addressed the further rejections of dependent claims as being moot in view of the amendments and remarks herein. However, Applicants expressly do not acquiesce in the Examiner's findings not addressed herein. Indeed, Applicants submit that the dependent claims recite further novel and non-obvious features of particular utility.

Request for Withdrawal of Finality and Refund of Fees

The presently-filed Request for Continued Examination was necessitated by the Examiner's Final Office Action mailed November 3, 2005 and the Advisory Actions mailed February 10, 2006 and April 6, 2006. In the Final Office Action, the Examiner asserted the

Appl. No. : 10/623,482
Filed : July 18, 2003

combination of Cote *et al.* and Luo *et al.*, while stating that Todd *et al.* supported the rejections, but was not relied upon. In response, Applicants pointed out that the combination was deficient and that Todd *et al.* was necessary to form a *prima facie* case of obviousness. Applicants further noted, however, that Todd *et al.* was not available, thus making the rejections deficient. See Response to Final Office Action, mailed January 3, 2006.

The Examiner then argued in the first Advisory Action (mailed February 10, 2006) that Todd *et al.* “can be applied under 102(a) and therefore is not precluded from being used as prior art against the present applicant’s [sic] invention.” Thus, the Examiner appeared to argue that Todd *et al.* was being used as prior art to satisfy the previously-noted deficiencies in his *prima facie* case. In response, Applicants noted that Todd *et al.* was, in fact, not available as the Examiner had asserted. See Supplemental Response to Final Office Action, mailed March 3, 2006.

In response, the Examiner issued the second Advisory Action (mailed April 6, 2006) and argued that Todd *et al.* was unnecessary since Brodsky *et al.* could be applied to “support the motivation.” Applicants note that if a reference is asserted to support the motivation, then it is necessarily part of the asserted combination, else the motivation is unsupported and the combination becomes deficient for lacking a proper motivation to combine. Suggestion or motivation is a required component of a *prima facie* case of obviousness. *In re Jones*, 21 U.S.P.Q. 2d 1941, 1943-44 (Fed. Cir. 1992).

Thus, from the Final Office Action to the first Advisory Action to the second Advisory Action, the Examiner has presented three different rationales for rejecting the claims: 1) based upon the combination of Cote *et al.* and Luo *et al.*; 2) based upon the combination of Cote *et al.*, Luo *et al.* and Todd *et al.*; and 3) based upon the combination of Cote *et al.*, Luo *et al.* and Brodsky *et al.* None of the changes to the Examiner’s rationale were necessitated by Applicant amendments. Applicants note, even if the teachings that the Examiner desires to read into the references have not changed, the legal basis relied upon by the Examiner to argue the propriety of the rejections has indeed changed, as have the references asserted by the Examiner. See, for example, the assertion of Brodsky *et al.* for the first time in the second Advisory Action. Because the legal basis for the rejections and the legal basis for the asserted availability of the asserted references and combinations have changed since the Final Office Action, Applicants

Appl. No. : 10/623,482
Filed : July 18, 2003

submit that the grounds for rejection have also changed. As a result, Applicants submit the Advisory Actions were improperly entered and that, instead, a non-final office action should have been mailed to allow Applicants opportunity to address the new legal and prior art grounds for rejection.

Consequently, Applicants request that the finality of the Office Action mailed January 3, 2006 be withdrawn and that a new, non-final Office Action be issued. Because the Advisory Actions are believed to be improper, Applicants also request a refund of the extension fees and the fees for the Request for Continued Examination in this case.

CONCLUSIONS


In view of the foregoing, Applicant submits that the application is in condition for allowance and respectfully request the same. If any issue remains which the Examiner feels may be addressed by Examiner's amendment, the Examiner is cordially invited to call the undersigned for authorization.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 5/3/06

By: 
Zi Y. Wong
Registration No. 58,410
Attorney of Record
Customer No. 20,995
(415) 954-4114

2566825
050106